

WINNER OF THE 2005 JOHN C. BURNHAM EARLY CAREER AWARD

Sponsored jointly by the Forum for History of Human Sciences
and the Journal of the History of the Behavioral Sciences

**FROM ETHER THEORY TO ETHER THEOLOGY: OLIVER LODGE
AND THE PHYSICS OF IMMORTALITY**

COURTENAY GREAN RAI

This article follows the development of physicist Oliver Lodge's religio-scientific worldview, beginning with his reticent attraction to metaphysics in the early 1880s to the full formulation of his "ether theology" in the late 1890s. Lodge undertook the study of psychical phenomena such as telepathy, telekinesis, and "ectoplasm" to further his scientific investigations of the ether, speculating that electrical and psychical manifestations were linked phenomena that described the deeper underlying structures of the universe, beneath and beyond matter. For Lodge, to fully understand the ether was to force from the universe an ultimate Revelation, and psychical research—as the most modern and probatory science—was poised to replace religion as the means of that disclosure. © 2007 Wiley Periodicals, Inc.

In July 1894, Oliver Lodge, the celebrated electromagnetic theorist who had recently made the first public demonstration of wireless telegraphy, quietly left his Liverpool laboratory for a remote island off the southern coast of France. He went at the invitation of French physiologist and future Nobel Prize winner Charles Richet and was joined by two other men distinguished in their fields, psychologist Frederic Myers and Julian Ochorowicz, a Polish professor of philosophy. The island was deserted save for Richet's rustic cottage and a lone lighthouse on the far end. The men gathered here, isolated from the possibility of both detection and interference, to investigate the strange physical phenomena alleged to occur in the presence of Eusapia Palladino. An elderly Neapolitan laundry woman, orphaned and uneducated, might seem a strange houseguest for this distinguished company, yet Eusapia had been gathering fame on the continent since the early 1870s. The claims about her powers had become so numerous and well attested that at last they seemed to demand the attention of scientific investigators (Carrington, 1909).¹

Lodge and his fellow investigators convened for their experiments in the late evenings, sitting around a table in the main hall. Monsieur Bellier, Richet's private secretary, sat just outside the window on the veranda, taking notes and observing that no one entered or exited the house. Eusapia sat at the same table and was subject at all times to

1. Eusapia Palladino was born in 1854 in a small village near Naples and attained renown as a medium on the continent, bringing her to the attention of Professor Lombroso, who, along with Richet, formed an investigatory committee in 1892, the Milan Commission. See Carrington (1909) for a biographical history and comprehensive chronicle of her investigations.

COURTENAY GREAN RAI received her PhD in modern European cultural and intellectual history from UCLA in November of 2005, where she currently holds a lecture appointment. Her dissertation, titled "The Substance of Things Hoped For: Faith, Science and Psychical Research in the Victorian *Fin de Siècle*," explores some of the synergies between psychical research (what we call today the paranormal) and important aspects of nineteenth- and early twentieth-century science. She recently won the John C. Burnham Early Career Award from the Forum for the History of the Human Sciences. She can be reached by e-mail at plscortena@aol.com or by writing her at History Department, UCLA, 6265 Bunche Hall, Westwood, CA 90095-1473.

controls intended to police her mediumship. Her feet were placed in an especially designed apparatus that would ring a bell if they broke contact with the floor, and the remainder of her person was physically restrained by the investigators themselves. At times, there would be one man lying under the table clasping her legs and another standing behind her with his arm hooked around her neck, while those still seated each took one of her hands and bound it tightly between both of their own (Lodge, 1932, pp. 293–313).² She was sometimes run with wires to see if some form of induction might occur in her presence due to an elevated surge of electromagnetic energy. Circle participants were even required to squeeze a dynamometer in their hand to register the vital power of their grasp before and after the séance, thereby recording the effects of the medium on their own bodies. Energy, its conservation, dissipation, or possible transmutation into extraordinary forms of activity, was always at issue when evaluating unexpected force phenomena (Noakes, 2002, pp. 126–155).³

According to Lodge's published account of these experiments (Lodge, 1894, pp. 300–360), heavy pieces of furniture flew around the room, the curtains billowed forcefully then gathered unmistakably into the form of a phantom face, and far from the medium's reach, an accordion played as the walls of the house cracked and shuddered. On one occasion, Lodge took a music box and suspended it from the ceiling nine feet beyond the reach of the medium. At his request, he heard it wind up and begin to play, then it snapped off its string and floated in a spiral onto the lap of Frederic Myers. From the depths of her trance state, Eusapia was even seen to excrete a limpid white substance that congealed into faint, phantom limbs extruding from her person. Richet introduced the idea of calling it "ectoplasm," speculating that the material was actually the medium's own vital protoplasm projected outside her body.⁴ According to investigators' accounts, the sitters could feel themselves slapped, pulled, or sometimes even violently pinched by these nebulous pseudopodia.

All of these phenomena (the movement of heavy objects without contact, the levitations, and the materializations) were opprobrious violations of the natural order—or were they? To Lodge's thinking, the only unacceptable hypothesis (i.e., one that smacked of the supernatural), was to explain these phenomena as mind "acting at a distance" on matter.

2. John Nevil Maskelyne (1839–1917), a skilled illusionist, demonstrated how an adept medium could simulate handholding in a darkened séance circle, thereby freeing herself to produce the expected phenomena. He and Lodge were involved in a public dispute over Maskelyne's charges that scientific observers, untrained in legerdemain, were in fact as vulnerable to deceit as the general public. For more on this, see Lodge's correspondence (1895, *Folios* 1026–1030, 1054–1065, 1235–1240, 1456–1458, *Lodge Papers*).

3. In his article "Instruments to Lay Hold of Spirits: Technologizing the Bodies of Victorian Spiritualism" (Noakes, 2002), Richard Noakes documents how physicists (both skeptical and sympathetic) adapted laboratory instrumentation to the investigation of séance phenomena. Starting in the 1860s, investigators began using conducting wires and galvanometers to import scientific objectivity into the séance circle. William Crookes developed his own specially rigged device to measure the foot/pound pressure of "psychic force" emanating from D. D. Home in a lab dedicated to this purpose (Crookes, 1874).

4. Lodge wrote, "With reference to the naming of ectoplasm and its recognition generally, I heard Myers, Richet, and Ochorowicz discussing it and calling it by this name on Eusapia's island before Myers' death. Whether the name was suggested by Ochorowicz or by Richet, I don't know, but I feel sure it was one of them and I think Richet claims it as his. It is a small matter and Myers' book appeared subsequently" (Lodge to William Barrett, October 2, 1924, *Folio* 134, *Lodge Collection*). Charles Richet remained a leading investigator of ectoplasmic phenomena well into the next century (Richet, 1923), along with German psychologist Albert von Schrenck-Notzing, an SPR affiliate who held similar ideas about the phenomena being formed "ideoplastically" out of the medium's own organism. See Dingwall (1921–1922, pp. 309–340) for a critical account of SPR investigators of materializations.

Lodge, first and foremost the man of science, did not subscribe to such “magical” operations as these. By his testimony, “Modern disbelief in magic is simply a statement of the conviction of mankind that all attempts in this direction have turned out failures, and that action-at-a-distance is impossible” (Lodge, 1883a, p. 304). (However, such scientific chastity might appear ironic under the circumstances.) Instead, Lodge postulated some kind of mediating ether through which the medium’s psychic force operated on her physical surroundings. The existence of the ether had been a central tenet of scientific orthodoxy since 1802, when light was determined to be a wave and ether the universal medium in which it propagated. This ether was at once an ontological mystery and an operational fact, dominating and revolutionizing the physics of the nineteenth century. Its conceptual plasticity allowed Lodge the latitude to propose that the strange phenomena he avowedly witnessed on the Ile Roubaud might ultimately be traced to an etheric substratum interacting with and conforming to the shape of a medium’s thoughts. In his official report, Lodge offered the ideoplastic ether as a tentative hypothesis only, but he did affirm the reality of Eusapia’s phenomena, whatever their explanation: “I have now definitely to state my conviction that certain phenomena of this class may, under certain conditions, have a real and objective existence” (Lodge, 1894, p. 307).⁵

What are we to make of such an extravagant experimental record full of dancing chairs, billowing drapes, and limbs made out of endogenous ether? I assume with confidence that Lodge at no time was a willing participant in a hoax, and that he believed these phenomena to be genuine. This article examines how Lodge, a proven experimenter, theorist, and public man of science, came to those beliefs, and eventually used them to catechize a kind of “ether theology” to a mesmerized public. Was Lodge simply swept up by a faddish mania and carried off over the deep end? Or, as he believed, did he arrive at these conclusions along a compelling current of available evidence and reasoned analysis? To answer that question, we must enter more deeply into Lodge’s own intellectual and methodological process.

In examining the genesis of Lodge’s religio-philosophical worldview, we find a cosmology not only historically conditioned by contemporary scientific norms and knowledge, but truly disciplined by what could be reasonably inferred from that knowledge or pursued within those norms. Recent historiography has shown the extent to which such metaphysical or fantastic speculation flourished in the midst (and not just in the margins) of mainstream Victorian scientific thinking throughout the nineteenth century. Historians like Alison Winter (1998) and Adam Crabtree (1993), by incorporating the wide range of early mesmeric beliefs back into the history of psychology, demonstrate how ideas once dismissed as quaintly Victorian must now be considered full partners in a dynamic field of thought out of which modern disciplinary science would eventually emerge. Jonathan Cerullo (1982), Janet Oppenheim (1985), Renee Haynes (1982), and Alan Gauld (1992) continue this theme by demonstrating the ongoing exchange of ideas and personnel between psychical research, physics, neurophysiology, and psychology in the latter half of the century. Pamela Thurschwell (2001) draws significant cultural connection by interpreting the psychic phenomena of telepathy and channeling as metaphors for the new sciences of telegraphy and telephony. These two modern tele-technologies enabled celebrated new forms of “action at a distance” but likewise triggered sexual anxieties and “fears of transmission” (hence, the displaced preoccupation with the uncanny, the unsettling, and the oc-

5. See Lodge (1894, pp. 306–360) for his official account in the *Journal for the Society for Psychical Research*. See also Lodge letters to Frederic Myers and William James (1894–1895, Lodge Papers).

cult). Richard Noakes (1999, 2002, 2004), on the other hand, suggests more concrete connections between developing modern technologies and spiritualism, showing how leading scientific experimentalists, by using modern scientific instruments and theories in their investigations of séance phenomena, related this research on a very practical level.⁶

My study, while drawing on the insights of recent historiographic trends, hopes to achieve an even deeper understanding of the interpenetration of scientific, psychical, and religious themes through the highly explicated mysticism of Oliver Lodge. What others veiled in analogy or deferred to some postmortem Revelation, Lodge continuously sought to bring into the light of plain-sighted science. With Lodge, the identification between physics, metaphysics, and psychical research went well beyond cultural milieu, intellectual adjacency, social networks, or association by metaphor (all significant points of contact ably established in other studies). Lodge's psychical research program served a single conceptual edifice in which the logical consistency of these component parts has yet to be fully appreciated by historians. It is my aim to mine the details of Lodge's interior logic to make greater sense of a big picture that could accommodate ectoplasm and energy physics, mind reading and mechanical thinking, in one internally consistent cosmology situated not "between science and religion" or on the sidelines of Victorian thought, but at the heart of a new cultural synthesis striving to thoroughly modernize the boundaries of belief.

THE SCIENTIFIC ZEITGEIST OF SPIRITUALISM

Lodge was born in 1851 in Penkhull, Staffordshire, the eldest of 14 children born to a struggling clay merchant. At an early age, he had shown a strange passion for science, mocking up electrical experiments with wires, weather vanes, and other handy pieces of household bric-a-brac. But when his father fell ill, Lodge was taken out of school and drafted into the family business as an itinerant housewares salesman. Undeterred, he managed to piece together a haphazard scientific education on the road, eventually enrolling in the University College London at the age of 23 to one day become one of the most highly decorated and popularly renowned scientists of his era.⁷

Lodge recalled with particular gratitude the program of public lectures offered by the Royal Institution of London, which he attended at every opportunity as a youth. For Lodge, "it became a sort of sacred place, where pure science was enthroned to be worshipped for its own sake" (Lodge, 1932, p. 75). He developed a missionary zeal for lay education, and from the start, his science seemed propelled by a great moral purpose, striding straight out of the midcentury ethos of evangelism. In his autobiography, Lodge referred to W. K. Clifford, T. H. Huxley, and John Tyndall as the most formative influences on his young mind, seeing in their fact-based, truth-seeking science the program he sought for universal progress (Lodge, 1932,

6. Apart from the scholarly literature, there are many histories of the early society written by the original researchers themselves. See Carrington (1914), Doyle (1926), Flournoy (1911), Lodge (1916), Myers (1893/1961), Podmore (1902, 1908), and Richet (1923). Unlike the strictly scholarly works that treat the phenomenon as a purely socio-cultural phenomenon, these accounts embrace the real possibility of the phenomenon and view it more as a historical agent rather than historical construct, vested with the powers to change the world. Later generations of SPR members, like J. C. Broad (1953), Alan Gauld (1992), and Renee Haynes (1982), are careful to give their histories a more analytical tone, creating distance between their intellectual judgment and their SPR affiliation. It can generally be acknowledged, however, that the underlying attitude toward the ontological status of the phenomena plays a role in conditioning the way it is written about—what is emphasized and what is assumed.

7. The Science and Art Department of South Kensington sponsored a series of classes on topics of general science in different towns across the country as part of an outreach program that Lodge attended in the late 1860s. See Lodge (1932, p. 107).

p. 168). As a boy, Lodge once saw Tyndall lecture at the London Museum of Geology and “internalized at that moment the high ideals in the attitude of a scientific man towards human life. It leads one to think that devotion to truth was the end and aim of everything” (Lodge, 1932, p. 75). But Lodge was also present at another speech that Tyndall gave, this one at the Belfast meeting of 1874 when Tyndall made his infamous assault on religion. Lodge recalled his dismay as “the atmosphere grew more and more sulfurous as the materialistic utterances went on” (Lodge, 1932, p. 110). By the time Lodge took his degree in physics, he was conscious of a deep gulf between his beliefs and those of his early scientific idols, remarking in reference to Tyndall that there “is a naturalist type of physics which rejoices in objects that appeal to the senses such as meteorological phenomena and glaciers. Professor Tyndall was strongly of that type, a good observer of natural phenomena” (Lodge, 1932, p. 139). Lodge, on the other hand, saw himself as “more abstract, rejoicing in the hidden forces, atomic occurrences, and other things which can never be seen as part of a non-sensuous reality” (Lodge, 1932, p. 110).

In this, he referred to the ether and electromagnetism. Against the grain of materialist philosophies arising in the life sciences, and the mathematical engine systematically converting the mysterious powers of magnetism, heat, light, and electricity into numeral equations, Lodge used ether to propel a far edgier metaphysic into the scientific discourse. Ether, the medium for pondering the imponderable, was a legitimating space where Lodge could launch an inquiry into “non-sensuous reality” while maintaining the object of his curiosity to be, still, “reality.” Lodge was not alone in this. Electricity (the deepest nature of which was understood to be ethereal) and spiritual phenomena had long been intertwined in the Victorian imagination. This scaffolding of ideas made spiritualistic phenomena appear more accessible to explanation, while suggesting, simultaneously, that it might be the purview of science, with its great onrush of electrical discovery, to explain them. As early as the 1850s, séance circles described the phenomenon of table wrapping as “spirit telegraphy,” while the developers of telegraphic technology, William Henry Harrison and Cromwell Fleetwood Varley, devoted themselves equally to communicating with spirits. Two leading physicists, Balfour Stewart and P. G. Tait, published *Unseen Universe* anonymously in 1875, using their knowledge of the scientific ether to argue for a physical continuity between this world and the next. The year before, the acclaimed physico-chemist William Crookes caused a stir with his publication of *Researches in the Phenomena of Spiritualism* (1874), in which the “psychic force” of famed medium D. D. Home was quantified under laboratory conditions. Crookes also photographed the full ghost of Katie King, materialized during a séance by the physical medium Florence Cook (an earlier episode related to the sort of phenomenon Lodge would encounter 20 years later with the partial materializations of Eusapia Palladino).

This fraternization between physics and psychics was actively derided by the more polemical naturalists, like E. Ray Lankester, who decried in a letter to the *Times* in 1876 that “men of science are not exempt as a body from the astounding credulity which prevails in this country and in America. It is therefore incumbent upon those who consider such credulity deplorable to do all in their power to arrest its development” (Palfreman, 1979, p. 224). Nonetheless, develop it did. Investigation of these phenomena was lent formal and informal support by a host of leading scientists and thinkers whose curiosity remained unallayed. Most notable among these were Lord Rayleigh (the third Baron), Balfour Stewart, William Crookes, J. J. Thomson, Henry and Eleanor Sidgwick, William F. Barrett, William James, A. R. Wallace, A. J. Balfour, and, of course, Oliver Lodge, all of whom would eventually become active members of the Society for Psychical Research. Even scientists openly critical of such pursuits, like Oliver Heaviside (who once referred to spiritualist investigators as “asses who

talked a sort of bastard science with no powers of discrimination whatsoever”), admitted to Lodge in his private correspondence that “the physical basis of these abnormal phenomena of course must some day be attacked by physicists” (Heaviside, 1895, UCL).

To explain this defection of so many physicists from the straight and narrow of Victorian scientific naturalism, one must consider the fascinating and sometimes freakish class of phenomena coming out of the world of experimental physics.⁸ With its cable telegraphy, fluorescent radiation, cathode rays, odic force, electromagnetic waves, and, eventually, the wireless, x-rays, and dubious n-rays, the world of physics often depicted a reality of strange possibilities. That these aberrational, elusive phenomena were brought somehow under the control of science, physically through experimentation and intellectually through ether theory, created a mood in science in the latter half of the nineteenth century that some great scientific epiphany awaited them in the ether. Lecturing in 1860, William Thomson heralded this mood when he declared, “It does seem that the unparalleled train of recent discoveries is tending toward a stage of knowledge in which laws of inorganic nature will be understood in this sense—that one will be known as essentially connected with all, and in which unity of plan through an inexhaustibly varied execution, will be recognized as a universally manifested result of creative wisdom” (Doran, 1975, p. 135).⁹

ETHER THEORIES

My main business was with the imponderables—the things that worked secretly and have to be apprehended mentally. So it was that electricity and magnetism became the branch of physics which most fascinated me. (Lodge, 1932, p. 111)

To appreciate the rigors of Lodge’s cosmology, it is necessary to understand how his thinking was built up within the discipline of late nineteenth-century ether physics. How could the ether be at once an affirmative argument for a mechanical universe as well as the formal basis for a new metaphysics?

Lodge inherited an ether that had been substantively and functionally revolutionized by the preceding generation of physicists. The program of Newton’s *Optiks* as interpreted and pursued by eighteenth-century investigators had left the early nineteenth with a plethora of force ethers explaining all the different functions of electrical, magnetic, gravitational, and optical phenomena (Heilbron, 1979).¹⁰ The failure to qualitatively connect all of these ethers into a grand phenomenon led to what Heilbron called a “theoretical vacuum,” and gave urgency to the early Victorian quest to explain and consolidate these ethers into a single substance. The development of the wave theory of light in the early part of the century demanded a new kind of ether, one that functioned primarily as a propagating medium for the transverse vibrations

8. Conservative scientists like Faraday and Thomson, part of an older generation charged with disentangling science and religion from natural theology, were alarmed, despite their deep personal faith in God, at this buckling of boundaries between science and spiritualism. They maintained the two inquiries of science and religion were separate spheres of knowledge and that this new “scientific spiritualism” was an irreverent and irrelevant bastardization of the two. For physicists of faith, both science and religion affirmed God’s design and wisdom—but along fully independent lines of reasoning. Yet a younger generation of scientists, coming of age after the triumph of evolution, did not mind re-entangling the domains of science and religion, perhaps confident in the fact that science would rule in the event that these kingdoms were reunited, substituting its reasoning for faith.

9. Original quote from Thomson’s Royal Institution Friday Evening Lecture, May 18, 1860.

10. *Optiks* offered a theory of ethers that direct through attraction, combination, or repulsion the interaction of all matter, and suggested a formal program of observation and mathematics somewhat ahead of its time, and not really pursued until the end of the eighteenth century. In *Optiks*, chemical, magnetic, and electric attractions are explained as “effluvial” and their action mechanical. See Heilbron (1979).

of light. It was this new concept of an “optical ether” that enabled scientists to eventually theorize the ether as a single, pervasive substance mediating the transmission of force through space. But first the understanding of force itself needed to be radically transformed.

Lodge identifies the “momentous beginnings” of modern ether science with Faraday’s famous effect of 1845, when he rotated an optical plane under the influence of magnetism, linking three of the imponderables under investigation: magnetism, electricity, and light (Lodge, 1881c, p. 303). Faraday’s work contributed to a growing understanding that “force,” rather than being a specialized property of matter, was perhaps a condition of “the surrounding field” mediating matter. For those who saw the significance of the field, the idea of the vacuum and, likewise, “action at a distance” would seem decisively denied in favor of a space occupied by a single, vast permeating medium in which all force could be transmitted (i.e., an all-pervasive, all-productive “ether”). This ushered in a new set of theoretical conditions that were to guide the midcentury investigation of electromagnetism as led by William Thomson, Peter Guthrie Tait, Balfour Stewart, Fleeming Jenkin, and Lord Rayleigh, culminating with James Clerk Maxwell’s electromagnetic theory of light. The prospect of a new, simplified ether explaining the form and function of imponderables propelled the hope that a unitary explanation integrating the totality of phenomena was at last within the reach of science. Such a cosmological vision would provide not just a gratifying windfall of understanding, but an explosion of cultural capital as well.

William Thomson, the chief architect of thermodynamics, offered one such compelling “unified field theory” by developing a vortex theory of matter adaptable to the existing dynamical scheme (Doran, 1975, p. 150).¹¹ His daring hypothesis not only integrated the theoretical explanations of electricity and magnetism with those of heat mechanics, but encompassed the very structures of the atom itself. In a paper he delivered to the Royal Society in 1856, Thomson suggested magneto-optical rotation (as originally observed by Faraday) to be the resulting strain produced by vortexes in the ether. These rotating vortexes, or “vortical-elastic structures,” constituted the singularities in the ether we recognize as matter—hence, the vortex atom. By the 1860s, the appeal of Thomson’s vortex theory of matter promised to displace the continental idea of “atoms in a void” in favor of heterogeneities of motion in a homogeneous ether, responsible for all the phenomena of electromagnetism and light. Lodge called Thomson’s vortical atom an idea so beautiful it had to be true. In his first public discussion of the ether, published by *Nature* in 1883, Lodge “endeavored to introduce the simplest conception of the material universe which has yet occurred to man” (Lodge, 1883b, p. 330).¹²

The conception is of one, universal substance, perfectly homogenous, and continuous and simple in structure, extending to the furthest limits of space of which we have any knowledge, existing equally everywhere. Some portions either at rest or in simple irrotational motion transmitting the undulations which we call light. Other portions in rotational motion, in vortices that is, and differentiated permanently from the rest of the medium by reason of this motion. These whirling portions constitute what we call matter. Their motion

11. Doran argues that Thomson’s vortex theory of matter did not stand in contrast to his kinetic theory of heat and its reliance on colliding particles, so Thomson should be read as attempting a unifying theory. She writes, “I believe that Thomson’s intent was to reconcile a continuous ether with the molecules of matter demanded by the kinetic theory of heat. Thomson suggested that the particles of matter in motion that cause heat exist as heterogeneities in the continuous plenum and produce all the phenomena of electromagnetism and light. It is evident that he envisioned vortical motions to occur in particles of matter which, being structures in the ether, effect by strain the rotatory momentum in the ether observed by Faraday” (Doran, 1975, p. 150).

12. The actual quote runs, “I have now endeavored to introduce you to the simplest conception of the material universe which has yet occurred to man” (Lodge, 1883b, p. 330).

gives them rigidity and of them our bodies and all other material bodies are built up. One continuous substance filling all space, which can vibrate as light, which can be sheared into positive and negative electricity, which in whirls constitutes matter, and which transmits by continuity and not by impact, every action and reaction of which matter is capable. . . . This is the modern view of the ether. (Lodge, 1883, p. 329)

A philosophically and physically crucial aspect of the vortex atom was that it offered a true particle-field paradigm, blurring the boundaries between motion, force, and matter. Thomson signaled this point as early as 1860, writing, “[W]e can conceive that electricity itself is to be understood as not an accident, but an essence of matter. It seems quite certain that electricity in motion is heat; and that a certain alignment of axes of revolution in this motion is magnetism” (Doran, 1975, p. 254). Thus, with classical simplicity, nineteenth-century physics reasserted motion at the center of all universal phenomena. Going beyond the austerity of Descartes’ system of atoms in motion, ether physics proposed the unitary solution of atoms of motion. Motion, in the form of elemental rotations in the ether, provided the fundament of all energy in the universe and structured all the physical articulations we recognize as force and matter.

The various patterns of energy exchange arising from this dynamical model of the ether were ordered and quantified by the laws of thermodynamics. There could be no cleaner reduction of so many complex phenomena, no more comprehensive mathematical inventory. Like Newton’s revolutionary understanding of gravity, thermodynamics was the next great leap of generalization in the struggle to systematize natural laws. But ether, like Newtonian gravity, left speculative room for God’s activity in the universe. It offered a degree of order and transparency to the operations of the universe while yet preserving its innermost ontological mystery. If for Newton gravity was the active presence of God’s will working everywhere in the world at once (a primary cause in a physical world of secondary causes and effects), then for spiritualists and other believers, the ether might prove some rarified form of His corporal essence, the medium by which ghostly specters haunted séance circles and apparitions appeared to sooth the bereaved. In this manner, the ether furnished endless possibilities to be explored by philosophers, scientists, and laymen, providing the physical and conceptual medium in which force, matter, and the cultural imagination were all interoperational.

THE METAPHYSICAL MECHANIST

The ether’s appeal lay at once in the daring reach of its explanation and its simultaneous accessibility and simplicity. In an article titled “The Foundations of Dynamics” written in 1893 for *The Philosophical Magazine*, Lodge wrote, “The more neatly and quietly a scientist can build his theoretical foundations, the more time he will have for building the superstructure and the more gorgeous he may hope to make it. . . . It must be as plain as it is substantial. Of this plain and substantial character would I like to keep the laws of motion” (Lodge, 1893b, pp. 6–7). By way of contrast, Maxwell had left the laws of electromagnetism in an inscrutable mathematical tangle, which Lodge and his generation of electromagnetic theorists were left to sort out.¹³ Lodge, in order to prevent “the physics of the future from being swal-

13. Lodge first encountered this theory at Maxwell’s presentation to the Bedford meeting in 1873. Lodge describes this as the most moving experience of his life, referring to the Treatise as “one of those immortal productions which exalt one’s idea of the mind of man.” In the same breath, Lodge goes on to compare it to the *Principia* but acknowledges that, unlike the *Principia*, it is not perfect. He writes, “Much of it is rough hewn and requires to be thoroughly worked out. It contains numerous misprints and errata and part of the second volume is so difficult as to be almost unintelligible” (Lodge, 1881c, p. 303).

lowed up by a barbarous jargon of technicalities" (i.e., mathematics) (Lodge, 1893b, p. 7), tried to render the relationship between Maxwell's mathematical formulas and William Thomson's elegantly mechanical vortex atom as a purely physical phenomenon (Hunt, 1991).¹⁴ In search then of this system of substantive as well as mathematical relations, he drafted mechanical models of the ether in order to physically represent the interactions between matter, electricity, and charge, as engineered from the Treatise's blueprints.¹⁵ With this penchant for mechanical realism, Lodge carried forth in the mid-Victorian spirit of one of his great scientific heroes, William Thomson, who wrote, "I am never content until I have constructed a mechanical model of what I am studying. If I succeed in making one, I understand; otherwise I do not" (Smith & Wise, 1989, p. 611).¹⁶

Lodge's textbook *Modern Views of Electricity*, first published in 1889, was the highest expression of Lodge's purely mechanical ether, outlining the physical theory onto which he would later graft his psychical theory of mind (see Figure 1). It was also this book that called forth the famous contumely of Pierre Duhem in *La Théorie Physique: Son Objet, et sa Structure* (1905/1954):

Here is a book intended to expound the modern theories of electricity and to expound a new theory. In it there are nothing but strings which move around pulleys, which roll around drums, which go through pearl beads; which carry weights; and tubes which pump water while others swell and contract. Toothed wheels which are geared to one another and engage hooks. We thought we were entering the tranquil and neatly ordered abode of reason, but we find ourselves in a factory (Mellor, 1968, p. 284).

That motion was at the center of physics in the 1880s, and that these motions were portrayed as mechanical actions, may have violated the sensibility of Duhem, but these ideas progress easily from the midcentury paradigm of a dynamical universe. The image of Victorian thermodynamics may invoke the cosmos as a machine converting energy from heat to motion and from motion to heat, driving the physical processes of the universe like so many gears and pistons, yet, it would be a mistake to overidentify dynamics with either matter or machine (Smith & Wise, 1989). The main idiom of thermodynamics was kinetic not atomic, and unlike the mechanical motions produced by a machine, the dynamical universe, at least as proposed by Thomson, was not fully deterministic. Despite some materialists' efforts to promote "a nature fast in fate to an extent not hitherto recognized" (Tyndall, 1900), Thomson's laws offered only statistical certainty, with the operating mechanism of "choice" (i.e., the actual direction a molecule took versus its statistically likely direction) maintaining a mysterious possibility of subjectivity at the heart of thermodynamics. Into the explanatory gap, encoding the principle of free will into the universe at the molecular level, was the tiny intelligence represented by Maxwell's demon, interpreted by Thomson as a micro-machine operator whose "tactile perceptive organization [gave] him the faculty of observing and influencing individual molecules of matter" (Smith & Wise, 1989, p. 623). The demon remained an important metaphor for

14. William Thomson worked out his vortex atom theory by 1856, and by 1867 the idea had a wide circulation. Although Thomson dumped the idea by 1877, having determined that the vortex structure was not stable enough to perform the mechanical actions indicated by Maxwell's equations, the idea remained current for Maxwellians such as Lodge and FitzGerald despite their disappointment at Thomson's repudiation. For more on this, see Hunt (1991) and Doran (1975).

15. Lodge more closely identified the ether with electricity than did either Maxwell, Thomson, or FitzGerald; thus, in some ways, Lodge's study of electricity was much closer to a sense of observing something that was ultimately real (the ether).

16. Originally quoted from William Thomson (1884), *Molecular Dynamics and the Wave Theory of Light*.



The vortex action in the ether shears the medium into positive and negative electricities, depicted here as cogwheels gearing into one another, rotating in opposite directions to represent positive and negative charge. The effect of having two adjacent wheels moving in opposite directions (i.e., possessing opposite charges) is that at their point of actual contact, they move in the same direction, providing—depending on relative speed—a near frictionless rotation. This enables the electrical spin to propagate throughout the dielectric medium. If all the wheelwork is perfectly geared together and spinning in this unrestricted fashion, then the field is said to be fully magnetized. This is because electrical energy in circulation is magnetic. But if there is a “slip” of these geared wheels, the positive going faster than the negative, or vice versa, then the rotational inertia is disturbed and the momentum is translated into the form of an electrical current. (Lodge represents this electrical current here as “a rack” moving through a set of pinioned cogs.) Unless it is a perfect conductor, such surges of current become remagnetized. Lodge explains a magnetized medium as one in which all the wheels are geared into each other and spinning in perfect harmony; the inertia of rotation is thus fully unobstructed. There is no slip, no electrical induction. But in a perfect conductor, Lodge imagines that these “wheels” are not geared together at all. (His illustration of this point removes the little toothed cogs from the wheels). There is no friction, no contact, no spin; there is only pure current. If the medium is not “magnetized,” Lodge suggests we imagine the wheels arrayed in random disorder, or stationary. Lodge does not explain whether these wheels represent atoms of matter or are purely electrical.

FIGURE 1.

A provisional representation of a current surrounded by a dielectric medium (from *Modern Views of Electricity* [1889], p. 186).

Lodge’s mechanics as well, a sort of scientific mascot he used with his nonscientific associates to demonstrate the reality of physical-psychical interplay at the most basic level of determination.¹⁷ Lodge may have espoused a mechanical cosmos, but his clocklike universe was only partially automated, leaving ample room for ghosts in the machine.

It was not that Duhem actually believed Lodge’s pulleys and gears were meant to literally represent the universe as a machine (or factory), and yet at the same time, he understood that *Modern Views*’ mechanical ether was rather more than the merely heuristic device Lodge claimed it to be (Lodge, 1889, p. 3).¹⁸ Duhem may not have objected to using a model as an

17. Lodge, Correspondence, 1894, Folios 1026, 1395, 1400, Lodge Papers.

18. Referring to the comparison between two analogues, he writes, “One must always be keenly on the look out for any discrepancy between the behavior of the two things, and a single contradictory discrepancy will be sufficient to overthrow the fancy that they may perhaps be really identical” (Lodge, 1889, p. 3). It could be argued that this statement itself is a provocative disclaimer because it implies that there “exists a fancy that they may really be identical” to be overthrown.

aid in working out a theory, but he strongly opposed making the model elemental to that theory (Mellor, 1968). And perhaps there was a case to be made that a naïve or realist tendency toward reification was at work in Lodge's textbook, despite Lodge's protestations that pulleys and gears were analogies only. For Lodge, a machine expressed an underlying reality of contact motion and embodied a specific logic of force, space, and time.¹⁹ The mechanical ether was therefore profoundly representative and not merely analogous. Given Lodge's essentialist attitudes about motion and force (clearly stated in his 1893 article "The Interstellar Ether," excerpted below), and the ways in which he deeply correlated mechanical and dynamical reasoning, it becomes clear why Duhem found Lodge's *Modern Views* so problematic. To Duhem, the British predilection for mechanical models was hopelessly tied to and limited by subjective physical experience, whereas mathematics (Duhem's "orderly abode of reason") stood outside these limitations. But for Lodge, our subjective experience was itself the object, not the obstacle, of deeper understanding:

We are all chiefly familiar, from our youth up, with two apparently simple things, motion and force. We have a direct sense for both these things. Motion and force are our primary objects of experience and consciousness, and in terms of them all other less familiar occurrences may conceivably be stated and grasped, and whenever a thing can be so clearly and definitely stated, it is said to be explained or understood; we are said to have a "dynamical theory." Anything short of this may be a provisional or partial theory, an explanation of the less known in terms of the more known, but motion and force are postulated in physics as the completely known and no attempt is made to press the terms of an explanation further than that: a dynamical theory is recognized as being at once necessary and sufficient. (Lodge, 1893c, p. 856)²⁰

That Lodge stood down from trying to determine what the ether *was* in favor of the presumably more modest program of what the ether *does* seems somewhat less restrained in the light of this declaration. Lodge's mechanical analogy performs rather a dynamical end run around forbidden noumenal arguments, in favor of the equally direct grasp of the kinetic thing in itself. The guarantee that the human mind could apprehend motion and force grounded much of Lodge's experimental, theoretical, and, importantly, philosophical program in science. He felt charged to defend scientific realism. It was his moral conviction that there was an underlying reality to empirical observation and that we could scientifically and experientially get hold of it. This was of course becoming an increasingly sentimental idea. The rise of mathematical instrumentalism in science, the radical subjectivity put forth in phenomenal psychology, and the cognitive utilitarianism of evolutionary models of mind (we know only what we need to know to survive), seemed to more and more isolate the human mental experience from the "realities" exterior to mind (Dale, 1989; Levine, 1993; Wolman, 1968).

Lodge's scientific strategy of mechanical modeling must be seen as developing out of his deeply personal mission to procure epistemological certainty in science, in which "truth was the end and the aim of everything." Something that can be represented dynamically is something not merely analogized, symbolized, or explained, but something fundamentally prior to

19. The fact that Lodge felt the need to disclaim such a view in his introduction to *Modern Views of Electricity* (1889) implies the charge was already in the air long before Duhem made his original criticism in 1905. The issue over mechanical versus mathematical language was part of an ongoing nineteenth-century debate between an empirical versus hypothetical strategy for scientific explanation, roughly identifying the British with the former and the French with the latter.

20. This viewpoint is also expressed in Lodge's earlier writing on mechanics (Lodge, 1881a, 1883a, 1885). It is an older position inherited from Thomson, one that Lodge originally embraced without modification.

representation, something understood. If the human sensation of motion orders, rather than is ordered by, consciousness, then there is a real basis for confidence in human powers of observation and the empirical knowledge they provide.

This helps to illuminate why mechanical models had such a broad appeal for Lodge and his fellow realists. However, in actuality, Lodge had already begun to question the efficacy of a purely mechanical model by the mid-1880s, before *Modern Views* was even published.²¹ But the nature of his critique is profoundly different from Duhem's objection. In the same article in which Lodge described the primacy of force and motion (1893c)—upholding the usefulness of the dynamical/mechanical model—he likewise challenged its completeness. Lodge invited his readers to dig even deeper into their subjectivity:

It is conceivable that for some things no purely dynamical explanation will ever be forthcoming, because something more than motion and force may perhaps be essentially involved. I have said that the things of which we are permanently conscious are motion and force, but there is a third thing which we have likewise been all our lives in contact with, and which we know even more primarily—life and mind. (Lodge, 1893c, p. 856)

Why, after over a decade of studying electromagnetism and seeking to satisfy his quest for a “sufficient and complete” theory via mechanical models, had Lodge decided that the failure to produce one may not be the fault of the physicists but perhaps a flaw in the premise of “the sufficiency of motion and force”? The answer lies in the *other* research Lodge was conducting alongside physical research.

THE SOCIETY FOR PSYCHICAL RESEARCH

Lodge came to the Society for Psychical Research (SPR) through his preexisting friendship with Edmund Gurney and Frederic Myers, two of its founding members. Although attempts to organize scientific investigations of séance phenomena had been under way since the 1850s, the SPR, by its very success, marked a unique departure from the many elite forays that had gone before. Henry Sidgwick's Cambridge Ghost Club (1850s), Alfred Russell Wallace's Dialectical Society (1869), and the short-lived Psychological Society of Great Britain (1875–1879) had begun in enthusiasm but somehow failed to sustain a following despite their intellectual and aristocratic gloss. But arguably, a substantive intellectual/academic structure simply could never have coalesced around so dubious an object of inquiry as spiritualism prior to the 1880s. The SPR, on the other hand, steadily gained in support from its founding in 1882, numbering over a thousand members by the turn of the century, and continues on to this day with headquarters in London and a regularly published journal.

There was little new about the SPR's membership to explain this change in fortune (recycling many of the same investigative personalities active in the 1870s), or even in its

21. “This mechanical view of the wave theory, as an actual bodily oscillation of some jelly-like substance, seems to me doomed. With great ingenuity it can be made to account for a multitude of the facts, and it apparently numbers among its present adherents the magnificent name of Sir William Thomson. I venture to think, nevertheless, that it will be abandoned; and the periodic disturbance which constitutes light will be sought, not in the mechanical oscillation of ordinary matter, but in the subtle oscillation of the electric medium as conjectured and more than half verified by Clerk-Maxwell. Calling a disturbance ‘electrical’ instead of ‘mechanical’ is rather like calling something chemical instead of physical, when we mean to say we do not understand it” (Lodge, 1885, p. 405).

protestations of irreproachable scientific restraint, an already familiar disclaimer. What had changed however was the category under investigation. The relabeling of spiritualistic phenomena as “psychical events” allowed them to merge with a massive new field of data coming out of French psychiatry—specifically, the women’s sanitarium at Salpêtrière. Charles Richet’s clinical studies of trance hysteria demonstrated the validity of alternate states of consciousness and likewise appeared suggestive of a host of aberrational mental phenomena, ranging from stigmata to thought reading. Though not fully documented, the more sensationalistic claims coming out of abnormal psychology correlated in interesting ways to the mediumistic trance of the séance circle. This allowed spiritualism to enter into an established academic discourse via the back door and enabled the SPR to follow in its wake. “Psychical” research created an organizational identity for the SPR that cross-linked to more orthodox disciplines (notably, physics and psychology) not only at the level of its membership but at the level of its research program as well. The SPR charged itself with the mission “to examine without prejudice or prepossession and in a scientific spirit, those faculties of man, real or supposed, which appear to be inexplicable on any generally recognized hypothesis.”²² The fledgling society saw itself as a fully scientific adjunct to mainstream science, unencumbered by the extra-scientific concerns of prestige and orthodoxy that hampered the Royal Society from joining in their quest for ultimate understanding.

Lodge had recently been granted a prestigious appointment to the University College, Liverpool, his star very much on the ascendant, when Myers and Gurney begged of him a favor early in 1883. There were two shop girls at a Liverpool drapery, a Miss E. and Miss R., who showed a remarkable ability to read each other’s thoughts. Myers and Gurney hoped that the notable Lodge might referee some local experiments on the girls as a skeptical scientific observer. Lodge was at first inclined to refuse the favor because he was both doubtful about such claims and concerned for his reputation. Eventually, Lodge condescended to join the investigation, seeing the affair more as a nuisance really than a matter of any real professional or scientific significance.

It so happened that Lodge was deeply impressed by what he saw—so much so that he took charge of a second set of experiments the following year, explaining in his report that “so long as one is bound to accept imposed conditions and merely witness what goes on, I have no confidence in my own penetration . . . but when [one] can arrange one’s own experiments, one gradually acquires a belief in the phenomena observed quite comparable to that induced by the repetition of ordinary physical experiments” (Lodge, 1884, p. 190). Lodge relocated the Misses E. and R. to the college as an extra precaution against collusion. He also introduced a headmaster and biologist to the study, both unknown to the girls (and each other) and presumably beyond suspicion. (Typical of the Society’s attitude, only the factory girls, a double liability in terms of class and gender, raised concerns for Lodge in terms of trustworthiness [Owen, 1990].)

A sample of the experiment follows. It featured Miss E. and the headmaster as agents looking at a card, the three of hearts, while the percipient (Miss R.), blindfolded and seated behind a wooden screen, was questioned by Lodge.

Miss R: Is it a card?

Lodge: Right.

22. Council of the Society, *Proceedings of the Society for Psychical Research*, Volume 1, 1882–1883, p. 3.

Miss R: Are there three spots on it? . . . Don't know what they are. . . . I don't think I can get the color. . . . They are one above the other, but they seem three round spots. I think they're red but am not clear. (Lodge, 1884, p. 195)

In another instance, the two agents were asked to look at separate objects, one an empty square the other a large X; the percipient produced a drawing of a square with an X in it. In another test, two agents stared at the cutout shape of a teapot, made from silver paper. One of the agents, however, kept thinking how like a duck the teapot looked. The percipient announced she saw a silver duck, but the drawing she made strongly resembled a crude reproduction of the teapot.

After analyzing the results of his experiments, Lodge concluded that the phenomena were real. Though Lodge denied offering a formal hypothesis, he did draw an analogy between the phenomenon of consciousness and the field model of electromagnetism, indicating a convergence between the physical and psychical aspects of the universe. The fact that in little over a decade, Oliver Lodge would offer the first public demonstration of wireless telegraphy gives this experiment and Lodge's understanding of it particular resonance. The transmission of thought waves from agent to percipient oddly anticipated the transmission of radio waves from telegraph to coherer. Lodge's report, published in the June 1884 *Proceedings for the Society of Psychical Research*, includes the following:

That the brain is the organ of consciousness is patent, but that consciousness is located in the brain is what no psychologist ought to assert, for just as the energy of an electric charge, though apparently on the conductor, is not in the conductor, but in all the space round it, just as the energy of an electric current, though apparently in the copper wire, is certainly not all in the copper wire, and possibly not any of it; so it may be that the sensory consciousness of a person, thought apparently located in his brain, may be conceived of as also existing like a faint echo in space, or in other brains, though these are ordinarily too busy and pre-occupied to notice it. (Lodge, 1884, p. 191)

In Lodge's interpretation of telepathic phenomena, "consciousness" is not confined to the physical apparatus of the brain but, like other force phenomena, exists also in the surrounding space, and arises from the relations between matter and the field. Lodge, who would invent the radio coherer ten years later, couched his explanation of the brain/thought relationship in a language that was often strikingly analogous to that of early radiotelegraphy. Lodge noted that the degree of efficacy in sending images varied from different combinations of percipients and agents. This might indicate not only a variation in ability from individual to individual, but also that the mind behaved much like a tuning fork, establishing a syntonistic resonance more easily with some (similarly attuned) minds than others. Lodge also found that some percipients were more sensitive to verbal projections, and some more sensitive to eidetic ones. This also implied that the physical apparatus of the brain "tuned in" to different frequencies of brain "waves," changing the way two individuals read the same field of consciousness. The overlapping of images might be understood as an interference pattern of the waves of thought spreading across the field.

The implications of these experiments went beyond just force physics and promised to revise the status of the mind (and therefore man) in the discipline of psychology as well. Neurophysiologists tended to place the mind in an evolutionary context, interpreting consciousness as a purely biochemical process elaborated from primitive sensory awareness over the aeons. This epiphenomenalist view then, as advocated by such Darwinian thinkers as E. Ray Lankester, H. Maudsley, and W. K. Clifford, held that consciousness, as an emergent property of matter, is extinguished with brain damage or death. Lodge felt that his study

proved that consciousness could indeed exist independently of the brain since thoughts traveled through the ether. However, Lodge did not yet feel that this evidence itself could be elaborated into a spiritualistic hypothesis. There were no grounds to equate disembodied thoughts with the human soul. Whatever the reality, these phenomena were clues to a greater unitary understanding of the cosmos, and scientists were professionally bound to investigate them. Lodge committed himself to joining the Society for Psychical Research the following year in 1884.

The Liverpool experiments introduced a new kind of data into Lodge's scientific analysis that would inflect all subsequent discussions of the ether with a deeper, metaphysical significance. But in 1889, a startling experience propelled him into regions where even metaphysicians feared to tread and attached his science to questions of even greater magnitude. When Frederic Myers became suddenly ill, Lodge was asked to oversee a séance on his behalf. Up until then, Lodge had remained aloof from such activity because of its odor of vulgar sensationalism. But Mrs. Piper was a special case—not a “turbaned gypsy,” but a proper middle-class lady sent from Boston on the recommendation of William James himself. The experience Lodge was to have with her would force his engagement of reality into a new realm of consideration.

The Piper sitting was held in Cambridge under the auspices of the SPR, whose members were there to ensure the strictest procedural controls. This was to be an experiment that presumed no spiritualistic hypothesis and aimed only to gather the facts of phenomena observed. Once she fell into her trance state, Mrs. Piper seemed able to search the minds of those present for private details of their lives, and as her altered state deepened, she began connecting to various “spirits” drifting in and out of range of her reception, like a “telephone operator” making connections at random. Lodge was startled to recognize his long-dead Aunt Anne speaking in “direct voice” to him from somewhere in the room.²³ She reminded Lodge “of her promise to come back if she could,” in a voice and manner Lodge felt sure he recognized. There were other communications from deceased relatives as well, filled with personal information that had the effect of converting Lodge to an entirely new consideration: was this fragmentary piece of Aunt Anne's consciousness a glimpse of an immortal or at least postmortal soul? And did this contact mean then that the human soul was a potential object of verification? Lodge wrote excitedly in his report for the Society Proceedings, “[T]wo worlds, the living and the dead, had at last been introduced, and surely science could have no more important invitation, no course of investigation of greater human consequence” (Lodge, 1890, p. 463).²⁴ His science, which had already begun to absorb metaphysics, now positioned itself to surround and assimilate the language of religion as well.

OLIVER LODGE, KEEPING IT REAL

It is interesting to note the passion with which Lodge made his Presidential Address to the Liverpool Physical Society later that year (December 1889). His topic was electricity and the ether, but his delivery was pure Revelation:

23. “Direct voice” was understood to be produced independently of the medium, whose vocal apparatus was temporarily commandeered by the communicating spirit.

24. See Jolly (1975, pp. 92–95) for more details about this séance. Lodge had Piper followed to determine if she investigated her sitters before meeting with them, and also tried to see how easy it would be to come by the information about his “Uncle Jerry's watch” that emerged during the séance. Lodge was convinced she was genuine.

The present is an epic of astounding activity in physical science. Progress is a thing of months and weeks, almost of days. The line of isolated ripples of past discovery seem blending into a mighty wave, on the crest of which one begins to discern some oncoming magnificent generalization. The suspense is becoming feverish, at times almost painful. (Rowlands, 1975, p. 121)

After a decade of investigation, Lodge had come to believe that the possibilities of psychical research were opening a new phase in the history of human understanding, demanding a reevaluation of the limits of knowledge as they applied to science, philosophy, and even faith. In 1891, having assumed the presidency of Section A of the British Association for the Advancement of Science, Lodge seized what he called this “cathedral opportunity” to sermonize the gathering at their annual meeting about this neglected mandate. He raised the forbidden specter of psychical studies, going so far as to liken the present body to the Vatican, squelching the Galilean torch held aloft by the SPR. Drawing on his own research, he announced, “It has been established by direct experiment that a method of communication exists between mind and mind irrespective of ordinary channels of consciousness and the known organs of sense. It may be by some direct physical influence on the ether, or some still more subtle manner. We must urgently inquire into the process” (Lodge, 1891, pp. 385–386).

For Lodge, at issue was not only the reluctance, or even hostility, of the scientific mainstream to admit the participation of psychical research, but the changing character of science itself. Lodge complained, “There is a general tendency to underrate the certainty of some of the convictions to which natural philosophers have gradually been impelled” (Lodge, 1891, p. 384); a state of science he later referred to as having the “taint of solipsism” (Lodge, 1905b, p. 294). It was no longer theological skepticism that threatened the social foundations, a trend Lodge saw as largely in remission, but rather the philosophical doubt internally corroding the word of science itself.

Though Lodge never formally entered the debate on the limits of empiricism conducted around the writings of Ernst Mach, Karl Pearson, and Henri Poincaré, he frequently disparaged the underlying nihilism he felt unified the range of their opinion. Lodge’s own philosophical position was opposed to the skepticism of both the materialists and the idealists, but it was the latter for which the hottest fires in hell burn.²⁵ Looking back on the nineteenth century, Lodge summed up his lifelong opposition to “anti-realism” in his Centenary Address, delivered to the University of London, titled “A Century’s Progress in Physics”:

Now, there is one doctrine that I think is wrong and that ought to be treated as a heresy. That we are not out for the truth but for usefulness. I suppose that the idea underlying this contention is that Reality is beyond us. They say, “The question of true or false has no meaning in science. All that one is concerned with as in the case of all scientific theory is its usefulness.” Now that is held by not unimportant people yet I believe that this

25. In *My Philosophy*, Lodge writes, “I rebel against much of the philosophy of Mach and often against the philosophy of Poincaré” (1933, p. 136). Karl Pearson he maligned as a solipsist in *Life and Matter* (1900, p. 67). In “The Foundation of Dynamics, Part I” (1893b), he accuses Pearson’s “Grammar of Science” of needless and dangerous obfuscation. In Part II, he takes Pearson, Mach, and Macaulay to task for attempting to render Newton’s first law “meaningless.” He also had a small public tiff with Pearson in *Nature* (January 10, 1895), titled “On the Peculiarities of Psychical Research.” He defends the SPR against Pearson’s criticism in that same magazine, saying that the positive results published by the Society are a result of a failure in scientific method. Pearson claims that the psychical researchers lacked “acumen,” while Lodge insists that SPR critics had no knowledge of the facts.

is entirely false, that it is a thing to guard against, that it is an idea to be contended against and fought as a heresy. We are out for truth. We may not get it, but that is our aim. (Lodge, 1927a, p. 23)

The key to epistemological realism for Lodge was the nature of “subjectivity” itself. In his address to Section A, he urged the physicists present that “we should trust consciousness, which has led us this far” (Lodge, 1891, p. 87). For Lodge, “consciousness” was the intersection between the mental field and the brain that bound and individualized it. “Consciousness is not a direct construction of mind itself . . . but arises from the relationship of mind to matter” (Lodge, 1897/1909, p. 128). Unlike the philosophical skeptics, Lodge believed that the senses, which mediated the relation between mind and matter, did not cut us off from reality, but rather, connected us to it. Sight, smell, touch, taste, and hearing were merely modifications of our fundamental ability to detect motion and force (the latter point Lodge argued in “The Interstellar Ether”). The “sensations” our senses produced were not synthetic and fragmentary, but, in fact, secondary attributes of what was an ultimately real, underlying whole.

But Lodge made an even subtler address to the issues of scientific epistemology. Not only did he assert that the kinetic intuition inherent in human consciousness guaranteed our sensuous perception of matter (along with the empirical principle), but he also maintained a role for consciousness in constituting the experience of such phenomena as force, time, distance, and speed as well. These features of spatial architecture were not so much absolute physical operations of the ether as they were absolute experiential inferences of mind engaging those operations. Over a decade before Einstein’s theory of relativity, Lodge was already framing physics from the point of view of the observer—while at the same time making it a foundation for *realism*, not relativism. The paradox is only a superficial one, if we understand the interplay between matter, mind, and motion set forth in Lodge’s model of the ether.

Inspired by a lecture he attended given by F. C. S. Schiller and John Muirhead on “The Nature of Time with Emphasis on the Direct Perception of Motion” in 1890, Lodge began to more systematically consider the structures of motion in relation to the structures of consciousness (Lodge, 1912, pp. 1–33).²⁶ Lodge began with the position set forth in *Modern Views of Electricity*, a model that ontologically linked force to motion and intuitively linked motion and mind. From these “neat and quiet” theoretical foundations,

26. This view is similarly put forward in his catechism for adult children, *Self and the Universe* (Lodge, 1907b, p. 24). This idea of the conscious construction of experience developed from more basic feelings of motion and force is broached at length in *The Interstellar Ether* (1893c, pp. 857–858): “If I were to make the attempt (to explain the experience of mind), I should find it necessary for the sake of clearness to begin with the simplest and most fundamental ideas, in order to illustrate by facts and notions in universal knowledge the kind of process which essentially occurs in connection with the formation of higher and less familiar conception, in regions where the common information of the race is so slight as to be useless. Beginning with our most fundamental sense I should sketch the matter thus: We have muscles and we can move. I cannot analyze motion, I doubt it if the attempt is wise, it is a simple and immediate act of perception, a direct sense of free unresisted motion. We may indeed move without feeling it, and that teaches us nothing, but we may move so as to feel it, and this teaches us much, and leads to our first scientific inference, viz. space; that is, simply, room to move about. We might have had a sense of being jammed into a full or tight packed universe; but we have not: we feel it to be a spacious one. Of course we do not stop at this baldness of inference: our educated faculty leads us to realize the existence of space far beyond the possibility of direct sensation; and further by means of the appreciation of speed in connection with motion, of uniform and variable speed, we become able to formulate the idea of ‘time’ or uniformity of sequence, and other more complex notions—acceleration and the like—upon a consideration of which we need not now enter.”

Lodge would build a “gorgeous superstructure” indeed. To explain electromagnetism, Lodge had depicted a whirling vortex filament around whose core perpendicular rings of force circulated. This circulation loop was “magnetism”; the shearing effect of the whirling filament was electricity. These perpendicular rings expanded outward when the amount of vortex energy being conveyed through magnetic force increased and contracted when the amount of vortex energy being conveyed through magnetic force decreased. The rate of vortical rotation and corresponding output of electrical force were inversely proportional to these fluctuations in the magnetic rings. Just like waves spreading out from a whirlpool, magnetism was the property that conveyed motion from place to place and constituted the power of inertia. Electricity was associated with the rotational speed and elastic rigidity of the vortex structure itself. The interaction of these two properties, inertia and elasticity, two phases of the same vortical motion in the ether, gave rise not only to the electromagnetic wave, or “light,” but to all the “physical” conditions of the universe: three-dimensional space, linear time, differential speed, and relative distance. How?

In an interview for *The Spectator* in 1891, Lodge explained, “Space is the static abstraction from motion and Time the Kinematic factor likewise extracted from the same experience” (Lodge, 1912, p. 14). This, in relation to electromagnetism and vortex theory, meant that because one of our experiences of electrical motion was that it travels—both in its transverse propagation as light waves and in the spreading of magnetic rings—distance, both vertical and horizontal, was implied. Another way of constructing distance, of course, was “space”; ergo “space is a static abstraction from motion.” Time and speed, in turn, were emergent properties coextensive with this inference of distance and the comparative conditions it generated. So not only did our organic senses of heat, light, taste, touch, smell, and sound derive from these simple rotational motions of the ether, but the deeper structural principles of our physical experience were likewise kinetic interpretations of the mind, rooted in reality by our direct mental apprehension of motion.

On these grounds, then, Lodge opened the meeting of the British Association for the Advancement of Science in 1891 with the proclamation that “I have faith in the Intelligibility of the Universe. Intelligibility has been the great creed in the strength of which all intellectual advance has been attempted” (Lodge, 1891, p. 385). For Lodge, human consciousness was part of a cosmic feedback loop from which the radical positivists were inexplicably trying to expel the sensory data of science. Lodge’s “doctrine of Ultimate Intelligibility” guaranteed that our subjective experience of the world “had its roots in the ultimate truth and reality of things” (Lodge, 1891, p. 385). “Ultimate intelligibility” deepened the significance of the perceptions of human consciousness, while psychical research broadened the spectrum of things to be perceived. Lodge’s philosophy combined these elements to form the basis for a new type of scientific epistemology, one that could overturn the limits inherent in the assumptions of both “uncertainty” and “the unseen.”

“FAITH IS THE SUBSTANCE OF THINGS”

Despite Lodge’s elaborate metaphysic of perception, his scientific philosophy begged a question that would properly push the ether into a religious idiom. What was first cause? What was, and what begat, motion? And how could science account for this deep perceptual coordination between motion and consciousness? G. F. FitzGerald, one of Lodge’s closest friends and something of a mentor, maintained that “motion was the thought of God,” offering a variation of the divine idealism of Bishop Berkeley, whose philosophy Lodge conditionally admired (Hunt, 1991, p. 8).

But whereas FitzGerald was a man of devout and unwavering belief, Lodge was less sure. Though his friend urged him in a letter that “he must find a true and living faith” (Hunt, 1991, p. 9), Lodge wanted his philosophy to be reasoned inductively from scientific fact, not deduced from religious, theoretic, or metaphysical principles, no matter how intuitively appealing. Lodge felt such cosmological problems as “first cause” could and should be reasonably hypothesized, but only within the framework of an empirical science; otherwise, no matter how true, they remained baseless fancies. But as yet, no such body of evidence had been sufficiently cultivated from which such a scientifically cogent Truth might arise; hence, the urgent necessity of accrediting the discipline of psychical research.

“Telepathy” as such was not in itself “concrete” evidence, but rather a compelling statistical inference in an oft-repeated set of data. That there was some kind of mental influence between mind and mind was patent, but what did it mean? Was there a physical nature to this psychical effect? Could science detect a thought as it rippled through the ether before vanishing into the mind? And if such effect did have a physical aspect, did it persist after death?

As a member of the SPR’s Committee on Physical Phenomena, which was established in 1887, and joined likewise by fellow physicist Lord Rayleigh and William Barrett, Lodge examined hundreds of accounts of all varieties of physical-psychical anomalies. These included levitation, telekinesis, percussive sounds, phosphorescent bodies floating in midair, flashing lights, and the materializations of scents, sounds, and “ectoplasm.” It remained for Lodge and the Committee to determine what, if any, relation these phenomena bore to the ordinary laws of matter and motion, and how these laws might then be understood in relation to the mind.

Lodge became convinced that physical phenomena, despite their ill repute even among Society members as conjurors’ tricks, held the key to understanding the ultimate cosmic law of continuity. It was at this physical-psychical boundary where the laws integrating ether, mind, and matter were to be found, and, more important, such phenomena offered up concrete proofs for even higher speculations. As Lodge’s ether whirling machine, a laboratory apparatus designed to detect the “connection between ether and gross matter,” had failed after three years to produce either evidence or understanding of its object, Lodge was becoming more and more convinced that new experimental protocols were necessary to reach beyond the conventions of mechanical investigation (Lodge, 1893c, pp. 727–804).²⁷

Thus in July 1894, Oliver Lodge found himself sitting around a table on a small Mediterranean island while a strange Neapolitan laundress flung her sorcery about the room, immersing Lodge in a veritable hailstorm of psychical energy that dramatically accelerated his changing attitudes toward the so-called physical universe. The phenomena Lodge witnessed on the island were of a new variety, going well beyond the retinue of mental effects with which he was already familiar. A heavy *escritoire* moved back and forth at the wave of Eusapia’s hand; supernumary limbs of ectoplasm fluttered around her body; violent bursts of energy pounded the séance table “like a sledgehammer” levitating and, fi-

27. Lodge had been exploring the nature of the physical connection between ether and matter in a laboratory built especially for that purpose in Liverpool since 1891. To this effect, he constructed what he called his “ether whirling machine.” This comprised two heavy iron discs each about a yard wide and a meter thick, with barely an inch between them, spun by a powerful dynamo achieving speeds up to 4,000 mph. The apparatus was designed to test whether or not matter “dragged” some of the ether along with it, and determine this effect by measuring its impact on the speed of a polarized beam of light (transmitted by the ether) sent round and round the annular space. For a detailed report of Lodge’s experiment, see Lodge (1893a) and Lodge (1897).

nally, overturning it; and all the while, grips, blows, and jabs were falling upon the investigators' arms and necks.

Lodge's report speculated that perhaps Eusapia's powerful psychic ideation used the ether "bound up" in her own biological mass to project forms external to her body or to direct the otherwise ordinary force, matter, and energy already latent in the ether or persons present (Lodge, 1894, pp. 306–360). What was clear was that such manipulations were only possible through the living agency of the medium herself. What was the nature of the ether, life, and mind that enabled Eusapia's extraordinary psycho-physical engagement of her environment? Surely, Eusapia's mediumship, which demonstrated the mind's psychical ability to engage and even at times control physical laws, proved that the mind could not be itself merely derivative of those laws. And as such, it also provided the scientific departure point for understanding the mind's ability to transcend those laws upon bodily death. For Lodge, the proofs found on the Ile Roubaud provided an inductive chain of evidence extending the principle of continuity between ether and matter, to force and mind, and even perhaps beyond, to "soul."

THE CRISIS OF FAITH IS FAITH ITSELF

The Synthetic Society, founded in 1896, provided the intellectual and social context in which Lodge began to draft his scientific "catechism which might, with some improvements, constitute a sound foundation for religion" (Lodge, 1906, p. 219). A relaunching of the Metaphysical Society, the Synthetic aimed to reopen formal dialogue between science and religion, "because," according to an inaugural address made by Lodge, "theologians, for the first time, realize they want to be in concordance with findings of science, and have so gathered to deal with this new noble class of difficulties" (Lodge, 1897/1909, p. 1).

Not everyone saw the program quite that way. Lodge found himself in polite conflict with those who sought to reconcile religion with science mainly by arguing that the "most positive science was based on a tacit system of axioms and postulates and intuitions and in reality not a whit stronger than religious doctrine" (Balfour, 1897, p. 2). This argument sought to preserve religion at the expense of science, by showing that they were both equally matters of "faith." Lodge, however, went the other way, sharply arguing against faith in favor of a more factual basis for religion. "Faith," he argued before the Society in 1897, "is a seriously defective form of rigorous proof. . . . A belief, true or false, does not constitute proof, but requires a further, verifiable formulation" (Lodge, 1897/1909, p. 2).

Although with such an agenda, Lodge must be seen as part of a longer historical cycle attempting to retrain the ever-shifting balance between science and religion, his particular synthesis offered a unique historicization of this ongoing dialectic. Lodge in some ways continued farther down the middle path walked by William Thomson and other midcentury energy physicists between the excesses of materialism, skepticism, and clericalism. But the ways in which Lodge differed philosophically were significant. Perhaps Lodge's most radical forwarding of the reformist tradition was the anthropic impulse that permeated his religious agenda. It was not just that science had freed faith from "groveling superstition" (Lodge, 1907a, p. 3) or rejected the humiliation of a wrathful, punitive God; Lodge's catechism actually began to close the ontological gap between God and man, vesting the human mind with some of the transcendent capabilities of the divine spirit.

In his religio-scientific pamphlet, "The Interaction Between the Mental and the Material Aspect of Things" (Lodge, 1903a), Lodge, arguing from the "empirical proofs" of psychical research, posited an emancipated humanity acting as a creative agent in its own

evolution. "To the extent of our ability," he wrote in reference to this point, "we are helping the Project and thus in some manner share the Divine Responsibility." By contrast, the progressive midcentury model offered by Thomsonian physics still maintained a humanity wholly subject to an omnipotent God, exercising "free will" only in a manner limited by the statistical laws of thermodynamics and utterly passive in terms of God's grace and God's creativity. In Lodge's souped-up anthropology, the integrity of these thermodynamical principles was preserved but supplemented to give the human mind greater creative latitude, including a role perhaps in man's own biological development. For Lodge, the laws of thermodynamics "do not exclusively cover the realm of Nature even on the material side. Life and Mind are in some respects outside, though interwoven, within its scheme. I do not suppose dynamical laws ever cease to be applicable. They are necessary but not sufficient" (Lodge, 1909c, p. 336).

ETHER THEOLOGY

Lodge's religio-philosophical viewpoint, elaborated in a formidable publishing campaign beginning in the late 1890s, took the midcentury idioms of biological evolution, scientific humanism, and evangelical Christianity, and crossed them to produce a new language blending moral, spiritual, and material progress into a vaguely Christian meta-material evolutionism, strongly dosed with contemporary discourses coming out of experimental psychology. Lodge did this by arguing that the basic animating principle of "Life" was part of the same creative impulse as "Mind," but in varying stages of their evolution. Mind was Life, but in a higher condition. As Life advanced into Mind, and Mind likewise attained higher states of what Lodge called "becoming," Mind organized more and more complex states of matter. Thus, there was a kind of tandem evolution, matter and mind (form and content), advancing together in reciprocal complexity, two parts of a unified whole.

But why did mind "dust-up," as Lodge put it, in the medium of matter at all (Lodge, 1912, p. 39)?²⁸ If mind could transcend matter, then why didn't it? To evince this higher purpose encoded within the laws of physical causality, Lodge offered as analogue the ontological interdependence of matter and force. "It is impossible," Lodge wrote, "to have force without a body which is exerting that force, and also without another body on which that force is exerted." (Lodge, 1881b, 553). Matter and force for Lodge were linked by the ether not only at the level of their physical creation (both arising from its motions), but, in a more abstract sense, at the level of their Created purpose. Lodge used this as a basis to infer a deeper analogue in the relationship of mind to the material physicality of the universe. Just as force needed matter to be realized, on a more complex level of organization, mind (psychical force) needed the evolving physical architecture of matter (i.e., the human brain) in order to experience itself as consciousness.

28. Lodge's thought was very much influenced by the works of his fellow SPR associates, Henri Bergson, Frederic Myers, and William James, as well as others active in the fields of cognitive philosophy and experimental psychology at the turn of the century. In *Modern Problems* (1912, p. 39), Lodge writes, "I find Bergson's philosophy peculiarly interesting to men of Science. Matter and Mind have a common ancestry, they have arisen from a kind of cell that is neither one nor the other and incorporates Life in its simplest germ and enabled life to gain a foothold on this planet. My own view is that Life does not exert Force and certainly does not supply energy, it just utilizes the Spontaneous activities of Nature. Bergson's argument is that Consciousness immerses itself in matter—he gives the metaphor of water tunneling through caves. Balfour's critique of Bergson is to a degree a religious one. I think he regards the flow of consciousness as more teleological, i.e. some kind of reunion with something higher. He doesn't understand why it would dust up with matter at all and just build on variations within the medium of matter as its ultimate aim."

Underlying these structures of motion, whose material iterations provided a scaffold for consciousness and gave rise to all the physical features of the universe, was the one demiurgic energy driving it all. For Lodge, if mind and motion were understood to be the dual extensions of one divine generative force (the Prime Mover and Prime Thinker), that would explain the unbroken communion existing throughout the cosmos binding together all the mutations of matter and all the configurations of consciousness. A deep principle of continuity underlay the superficial atomism and mental alienation of our experience connecting us to something ultimate and universal. This essential relatedness of kinetic and psychic causality upheld our cognitive intuition of motion and inner sense of “life and mind,” as originally described by Lodge in “The Interstellar Ether” (1893c). Human beings, structured by the confluence of these ultimate energies of mind and motion, were simultaneously embodied and conscious, empirical and spiritual, created and creative, evolving freely in a morally determined universe and living on after death in the permanence of divine memory.

THE RELIGION OF SCIENCE

Defending his creed against charges of Godless humanism by religionist members of the Synthetic Society, Lodge explained they have “misunderstood my attempt at a fundamental religious statement from a scientific point of view. . . . I have not set off in a cold-blooded spirit on a merely ethical by-way” (Lodge, 1906, pp. 1–2). And yet in an article he wrote for the *Contemporary Review* in 1903, we can see how he ordered the hierarchy of knowledge: “The business of science is with foundations, the business of religion is with superstructure” (Lodge, 1904, p. 798). This was not the traditional top-down pyramid, but one in which religious belief was assembled from the bottom up and based solely in the imprint of scientific knowledge. Lodge also gave the midcentury “crisis of faith” a purely scientific phrasing for the turn of the century, further demoting the role and relevance of religion even in the spiritual struggles of man. “The crisis” was no longer a problem of canonical theology in conflict with science, but rather a conflict within the canons of science itself, to be solved by scientists through a disciplinewide reevaluation of the mind-matter relationship, as facilitated by psychical research. In “The Outstanding Controversy Between Science and Faith,” (1902) he wrote:

The root question or outstanding controversy between science and faith rests upon two distinct conceptions of the universe: the one, that of a self contained and self sufficient universe, uninfluenced by any life or mind except as such as is connected with a visible and tangible material body; and the other conception, that of a universe permeated through and through by living minds . . . where reign laws hitherto unimagined by science, but laws as real and as mighty as those by which the material universe is governed. (Lodge, 1902, p. 60)

Despite Lodge’s protestations that he was not just some ethical humanist but out to make a “fundamental religious statement,” in many ways, his cosmology so emphatically privileged scientific epistemology that, understandably, he alarmed even progressive religious sentiments. Yet, Lodge’s “faith” in a sweeping scientific theory encompassing explanations of an evolutionary telos and life after death effectively mooted such oppositional distinctions between science and religion, submerging these modern categorical boundaries through its style of certainty and sphere of inquiry. Lodge’s “ether theology” cross-linked experimental narratives of the mind with the physical certainties of a kinematic ether, creating an epistemologically truthful science whose central mind/matter hy-

pothesis was empirically sanctioned by the evidential findings in psychical research. The evidence Lodge wanted science to consider as objectively real (and therefore subject to investigation and verification) included internal psychological states, like intuition, precognition, religious inspiration, telepathic communication, and the continuance of human consciousness after bodily death. But in so doing, this scientific discourse of mind had expanded to absorb much of the traditional language of the soul, rather than reducing the language of the soul to a scientifically suitable convention of mind. And though Lodge replaced the religious epistemology of Revelation with an anthropocentric knowledge argued from empirical fact and logical analysis, he was ultimately proposing a new formulation for God and divine anthropology. Thus, his thinking defies easy reduction. The program of “Ultimate Intelligibility” did not seek to make mysteries mundane, but rather to render scientific knowledge itself more profound. He asked that the mission of science be redefined in the process of its own investigation, and in that redefinition fully assume, rather than negate or ignore, the burden of man’s spiritual and philosophical inquiry.

REFERENCES

Archival Sources

Archives for the Society for Psychical Research, Department of Manuscripts and University Archives, Cambridge University Library: Oliver Lodge Papers (Boxes 1–11).
 Special Collections, London University: University College London (UCL): Oliver Lodge Papers (Boxes 1–7).
 Manuscript Room, British Library: Oliver Lodge correspondence with A. J. Balfour 1899–1917 (Add. 49798 ff. 88–157).
 Wren Room, Trinity College Library: Frederic Myers Papers (Boxes 1–34).

- Balfour, A. (1879). *A defence of philosophic doubt: Being an essay on the foundation of belief*. London: Macmillan and Co.
- Broad, J. C. (1953). *Religion, philosophy, and psychical research*. New York: Harcourt, Brace.
- Carrington, H. (1909). *Eusapia Palladino and her phenomena*. New York: B. W. Dodge & Co.
- Carrington, H. (1914). *The problems of psychical research: Experiments and theories in the realm of the supernormal*. New York: W. Rickey & Co.
- Cerullo, J. (1982). *The secularization of the soul*. Philadelphia: Institute for the Study of Human Issues.
- Council of the Society. (1882/1883). *Objects of the Society. Proceedings for the Society for Psychical Research*, 1, 3.
- Crabtree, A. (1993). *From Mesmer to Freud*. New Haven and London: Yale University Press.
- Crookes, W. (1874). *Researches in the phenomena of spiritualism*. London: J. Burns.
- Dale, P. A. (1989). *In pursuit of scientific culture: Science, art and society in the Victorian age*. Madison, WI: University of Wisconsin Press.
- Dingwall, E. J. (1921–1922). *The hypothesis of fraud*. *Proceedings of the Society for Psychical Research*, 32, 309–340.
- Doran, B. G. (1975). *Field theory in nineteenth century Britain*. In G. Cantor (Ed.), *Historical studies for the history of science* (pp. 140–259). Princeton, NJ: Princeton University Press.
- Doyle, A. C. (1926). *The history of spiritualism*. London and New York: Cassel.
- Duhem, P. (1954). *The aim and structure of physical theory* (P. Weiner, Trans). Princeton, NJ: Princeton University Press. (Original work published 1905)
- Flournoy, T. (1911). *Spiritism and psychology*. New York: Harper Brothers.
- Gauld, A. (1992). *A history of hypnotism*. Cambridge, UK: Cambridge University Press.
- Haynes, R. (1982). *The society for psychical research*. London: Macdonald.
- Heilbron, J. L. (1979). *Electricity in the 17th and 18th centuries: A study of early modern physics*. Berkeley, CA: University of California Press.
- Hunt, B. (1991). *The Maxwellians*. Ithaca, NY: Cornell University Press.
- Jolly, W. P. (1975). *Oliver Lodge*. Rutherford, NJ: Fairleigh Dickinson University Press.
- Levine, G. (1993). *By knowledge possessed: Darwin, nature, and Victorian narrative*. *New Literary History*, 24(2).
- Lodge, O. (1881a). *Elementary mechanics, including hydrostatics and pneumatics*. London: Chambers.
- Lodge, O. (1881b). *On action at a distance and the conservation of energy*. *The Philosophical Magazine*, 11, 533.

- Lodge, O. (1881c, January 27). The relation between electricity and light. *Nature*, 28, 301–306.
- Lodge, O. (1883a). The ether and its functions I. *Nature*, 27, 304–307.
- Lodge, O. (1883b). The ether and its functions II. *Nature*, 27, 330–333.
- Lodge, O. (1884). Experiments in thought transference. *The Proceedings for the Society for Psychical Research*, 2, 189–200.
- Lodge, O. (1885). The wave theory of light. *The Engineer*, 59, 402–405.
- Lodge, O. (1889). *Modern views of electricity*. London: Macmillan and Co.
- Lodge, O. (1890). Account of sittings with Mrs. Piper. Formal Report. *The Proceedings for the Society for Psychical Research*, 2, 443–659.
- Lodge, O. (1891). Section A. Mathematics and physics, Opening address by Prof. Oliver J. Lodge, President of the Section. *Nature*, 64, 382–387.
- Lodge, O. (1893a). Aberration problems. A discussion concerning the motion of the ether near the earth and concerning the connexion between ether and gross matter; with some new experiments. *Philosophical Transactions of the Royal Society of London, Series A*, 184, 727–804.
- Lodge, O. (1893b). The foundations of dynamics, Part I. *The Philosophical Magazine*, 36, 6–7.
- Lodge, O. (1893c, June). The interstellar ether. *Fortnightly Review (London)*, 53, 856–864.
- Lodge, O. (1894). Experience of unusual physical phenomena occurring in the presence of an entranced person. *Proceedings of the Society for Psychical Research*, 6, 300–360.
- Lodge, O. (1897). *Philosophical transactions of the Royal Society of London*, clxxxix 189, 149–166.
- Lodge, O. (1900). *Life and matter*. London: Williams & Norgate.
- Lodge, O. (1902). Our place in the universe. An address to the members of the Nelson Street adult school. Sunday morning August 17th 1902. Birmingham, UK: John A. Hodges, Printer.
- Lodge, O. (1903a). The interaction between the mental and the material aspect of things. London: Spottiswoode and Co.
- Lodge, O. (1904). Religion science and miracles. *Contemporary Review*, 86, 798–811.
- Lodge, O. (1905a). *Life and matter*. London: Williams & Norgate.
- Lodge, O. (1905b). Note concerning thought and reality. *Mind*, 14, 294.
- Lodge, O. (1906). *First Principles of Faith*. *The Christian Commonwealth*. 26, 219.
- Lodge, O. (1907a). *Ecce deus: The essential element in Christianity*. London: Privately published.
- Lodge, O. (1907b). *Self and the universe*. London: Spottiswoode.
- Lodge, O. (1909a). *Faith*. Papers read before the Synthetic Society. London: Spottiswoode Press. (Original work published 1897)
- Lodge, O. (1909b). *The nature of proof*. Papers read before the Synthetic Society. London: Spottiswoode Press. (Original work published 1897)
- Lodge, O. (1909c). Supplements to the discussion of Mr. Balfour's Paper, presented to the Synthetic Society in June, 1900. *Papers Read before the Synthetic Society*, 336. London: Spottiswoode Press.
- Lodge, O. (1912). *Modern problems*. London: Methuen & Co., Ltd.
- Lodge, O. (1927a). A century's progress in physics, second of a series of centenary addresses. Delivered on Monday, March 14, 1927. London: University of London Press.
- Lodge, O. (1932). *Past years*. New York: Charles Scribner's Sons.
- Lodge, O. (1933). *My philosophy*. London: E. Benn.
- Mellor, D.H. (1968). Models and analogies in science: Duhem versus Campbell. *Isis*, 59, 282–290.
- Myers, F. W. H. (1961). *Fragments of inner life: An autobiographical sketch*. London: Society for Psychical Research. (Original work published 1893)
- Noakes, R. J. (1999). Telegraphy is an occult art: Cromwell Fleetwood Varley and the diffusion of electricity to the other world. *The British Journal for the History of Science*, 32 (115), 421–459.
- Noakes, R. J. (2002). Instruments to lay hold of spirits. In I. R. Morus (Ed.), *Bodies/machines* (pp. 125–163). New York: Berg.
- Noakes, R. J. (2004). Spiritualism, science and the supernatural in mid-Victorian Britain. In N. Bown, C. Burdett, and P. Thurstwell (Eds.) *The Victorian supernatural* (pp. 23–43). Cambridge: Cambridge University Press.
- Oppenheim, J. (1985). *The other world: Spiritualism and psychical research in England, 1850–1914*. Cambridge, UK: Cambridge University Press.
- Owen, A. (1990). *The darkened room*. Philadelphia: University of Pennsylvania Press.
- Palfreman, J. (1979). Between skepticism and credulity: A study of Victorian scientific attitudes to modern spiritualism. *The margins of science*. Keele, UK: University of Keele.
- Podmore, F. (1902). *Modern spiritualism, a history and a criticism*. London: Methuen.
- Podmore, F. (1908). *The naturalization of the supernatural*. London: G.P. Putnam's Sons.
- Richet, C. R. (1923). *Thirty years of psychical research; Being a treatise on metapsychics*. New York: Macmillan.
- Smith, C., & Wise, N. (1989). *Energy and empire: A biographical study of Lord Kelvin*. New York: Cambridge University Press.
- Stewart, B., & Tait, P. G. (1875). *The unseen universe or physical speculations on a future state*. New York: Macmillan.
- Thomson, W. (1884). *Molecular dynamics and the wave theory of light*. Baltimore: A.S. Hathaway.
- Thurstwell, P. (2001). *Literature, technology and magical thinking, 1880–1920*. Cambridge, UK: Cambridge University Press.

- Tyndall, J. (1900). Belfast Address to the Annual Meeting of the British Association for the Advancement of Science, 1874. In *Fragments of Science; a series of detached essays, addresses and reviews*, by John Tyndall (pp. 67–74). New York: D. Appleton and Company
- Winters, A. (1998). *Mesmerized: Powers of mind in Victorian Britain*. Chicago: University of Chicago Press.
- Wolman, B. (1968). *The historical roots of psychology*. New York: Harper & Row.